

# Genetic Monitoring of National Fish Hatcheries and Natural Populations in the Pacific Region

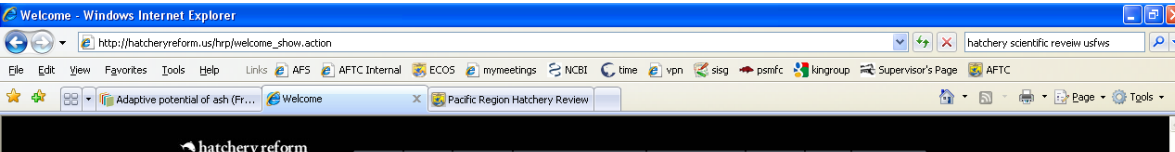


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\*Photos by R. Sorensen, R. Wong, and C. Smith

# Hatchery Scientific Review



## Hatchery Reform

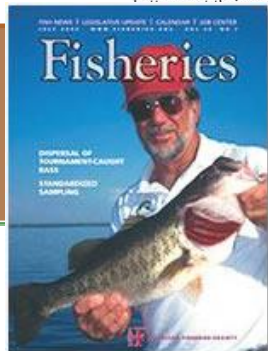
### Welcome to Hatchery Reform

Welcome to the website for the Pacific Northwest Hatchery Reform Project. The US Congress established the project in 2000 because it recognized that while hatcheries play a legitimate role in meeting harvest and conservation goals for Pacific Northwest salmon and steelhead, the hatchery system was in need of comprehensive reform.

The project's independent scientific review panel, the [Hatchery Scientific Review Group](#) (HSRG), has reviewed all state, tribal and federal hatchery programs in Puget Sound and Coastal Washington, and in the Columbia River Basin.

## Hatchery Reform in Washington State: Principles and Emerging Issues

Hatcheries support nearly all major fisheries for Pacific salmon (*Oncorhynchus* spp.) and steelhead (anadromous *O. mykiss*) in the Pacific Northwest. However, hatcheries have been a major source of controversy for over 30 years. The Hatchery Scientific Review Group (HSRG) was tasked by Congress to identify solutions to well-known problems so hatcheries could support sustainable fisheries and assisting with the conservation. We reviewed over 100 facilities and 200 programs and identified hatchery reform: (1) goals for each program must be explicitly stated in its and purposes; (2) programs must be scientifically defensible; and must respond adaptively to new information. We also identified several to the success of hatcheries. We concluded that hatcheries must with increased scientific oversight and that they cannot meet their habitats and self-sustaining, naturally-spawning populations.

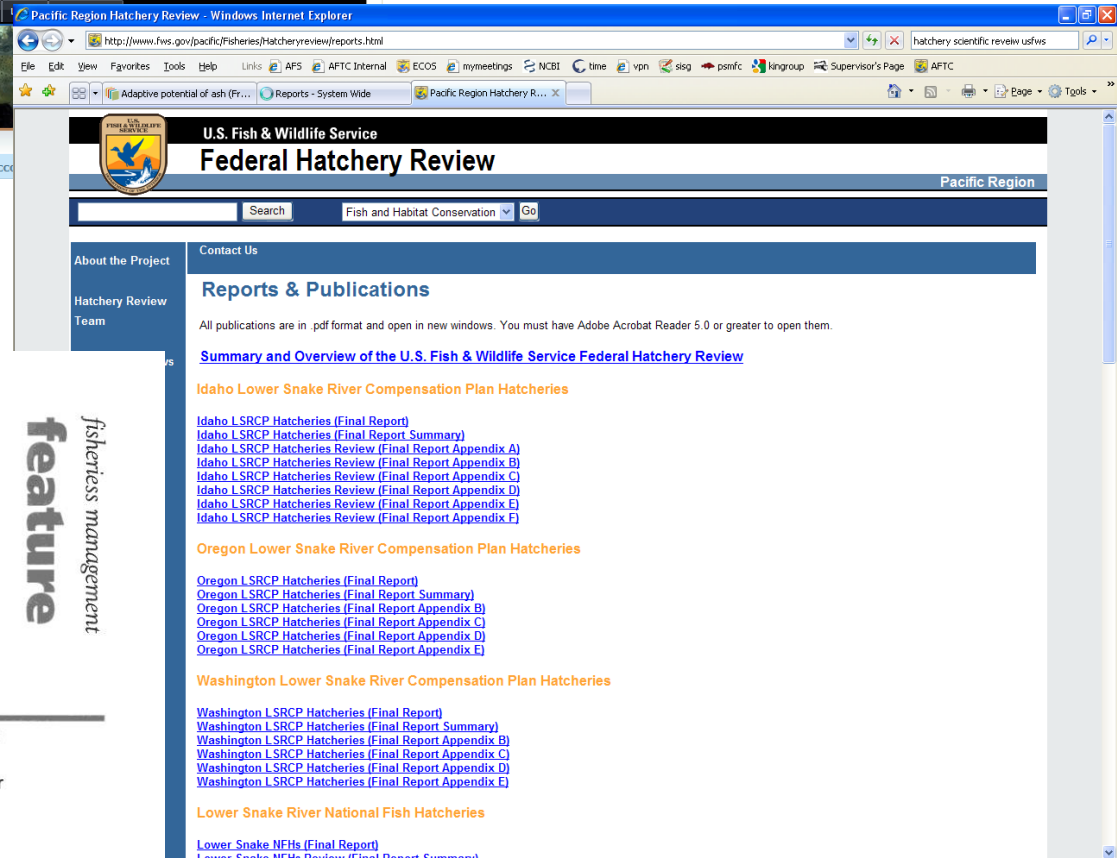


system for Pacific salmon (*Oncorhynchus* spp.) and developed over the past 100 years in the Pacific. The effects of overfishing, logging, agriculture, and associated losses of freshwater salmon habitats Washington Department of Fish and Wildlife American tribes, and the U.S. Fish and Wildlife 100 hatchery facilities within Puget Sound and the state. These hatcheries release more than 100 million each year and contribute approximately 70% in Puget Sound (WDFW 1997). The state of tribes of western Washington jointly manage fishery resources in western Washington and are collectively referred to as "co-managers."

feature  
fisheries management  
ABSTRACT

### Hatchery Scientific Review Group:

Lars E. Mobrand, Chair  
John Barr  
Lee Blankenship  
Donald E. Campton  
Trevor T. P. Evelyn  
Tom A. Flagg  
Conrad V. W. Mahnken  
Lisa W. Seeb  
Paul B. Seidel



# Examples of questions raised during the hatchery reviews:

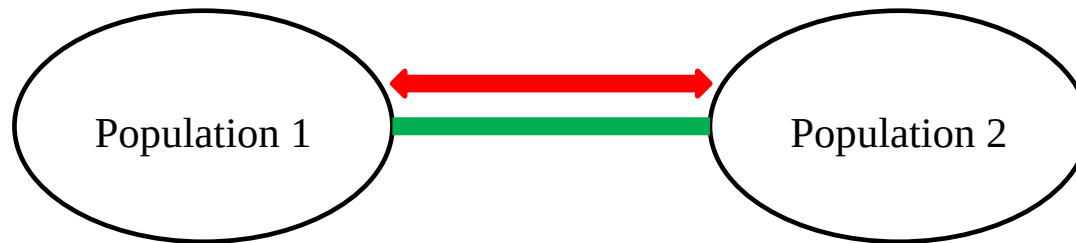
- Which individuals (based on age, return time, etc...) should be included in broodstock?
- What is the present relationship between hatchery stock and adjacent wild stocks?
- How can we monitor the impacts of changes made based on hatchery scientific review?

# Objective:

Develop standardized genetic profiles for  
National Fish Hatchery stocks

1. Use genetic data to address questions raised by Hatchery Scientific Review
2. Make data for all NFH stocks and adjacent wild populations readily available for internal evaluation and to our partners

# Review of genetic divergence



Genetic drift and different selective pressures in hatchery and wild environment will cause stocks to diverge

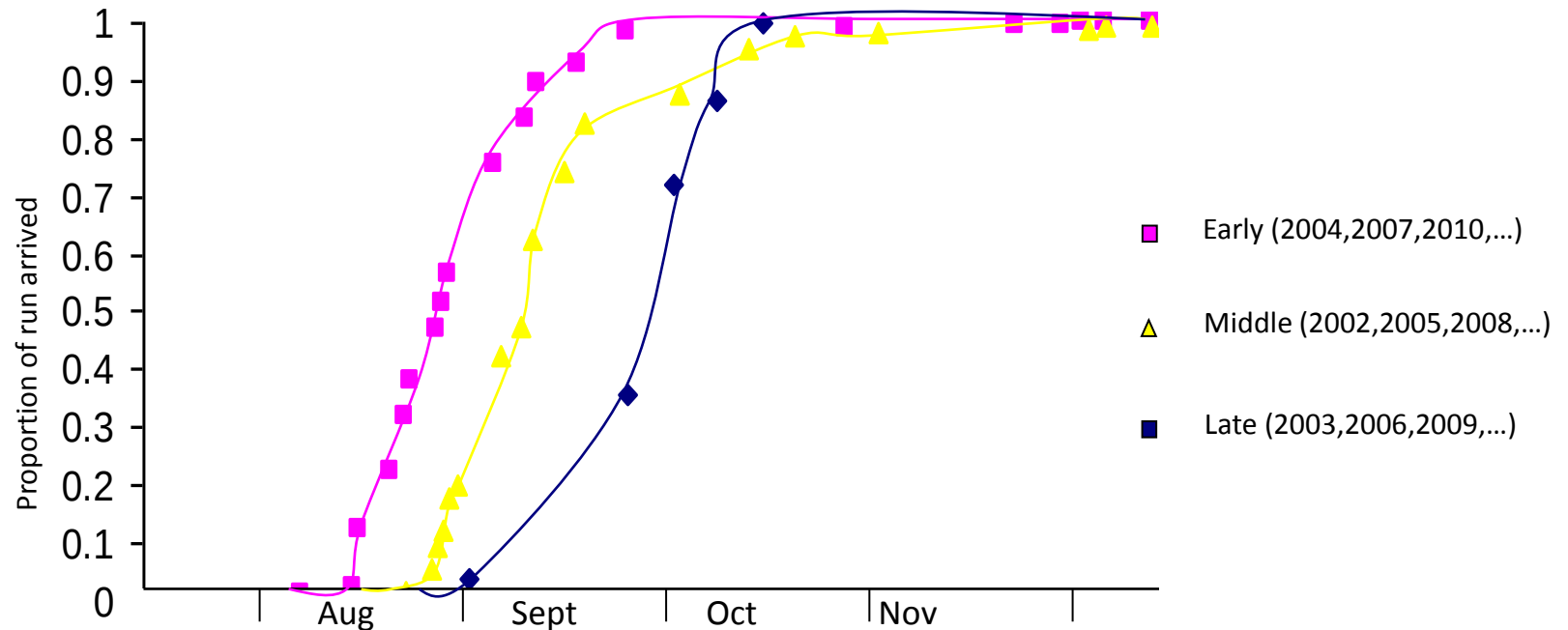
Gene flow will cause stocks to become similar  
(pHOS, pNOB, pNI)

# Example 1: Quilcene NFH

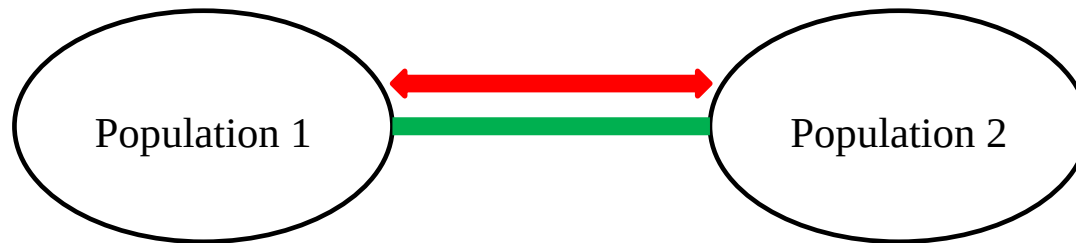


- Propagating coho for ~100 years
- Earliest returning fish used for broodstock
- Jacks excluded from broodstock prior to 1992

# Divergence in return time among three return years



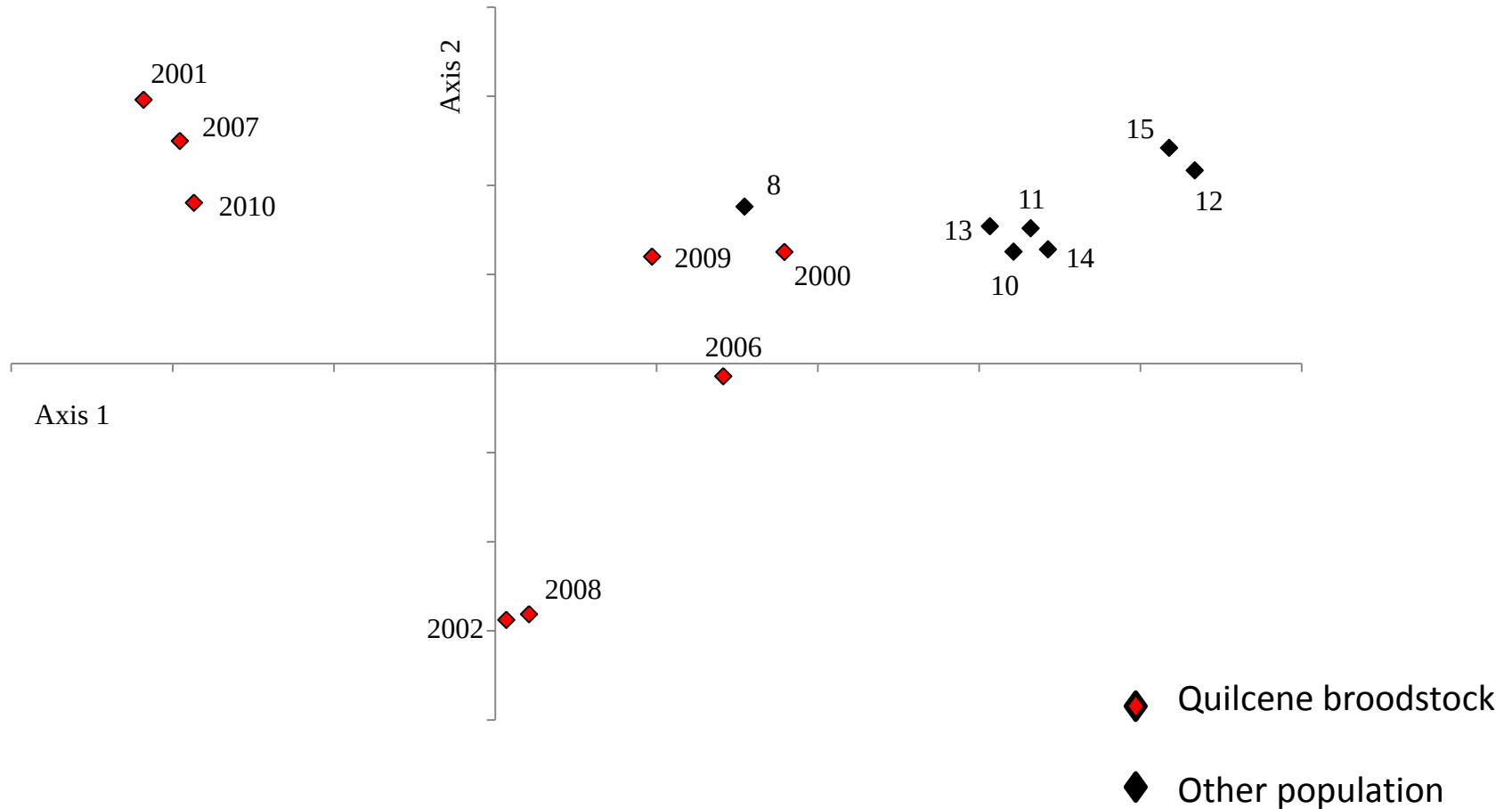
# Genetic divergence measured by neutral markers



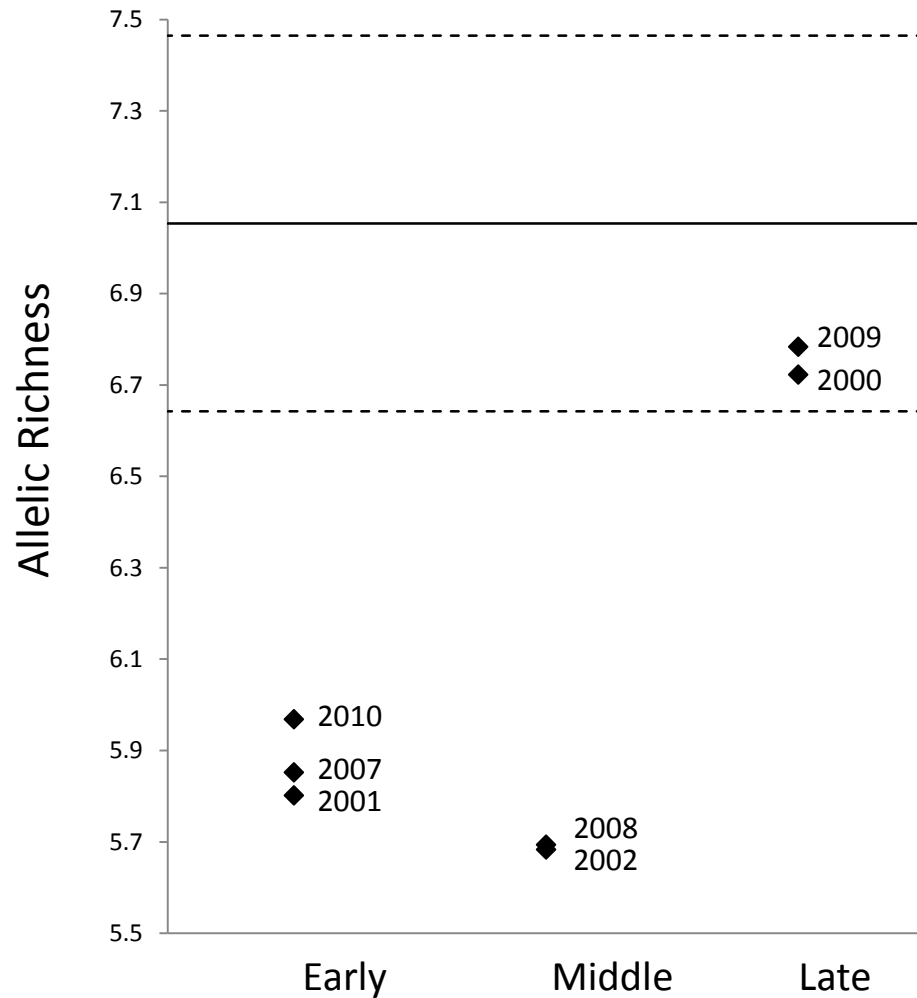
Can we detect genetic divergence corresponding to phenotypic divergence?

Has increasing proportion of jacks in recent years made a detectable impact on population structure?

# Temporal structure >> geographic structure



# Genetic diversity in Quilcene NFH coho salmon



# Example 2: Warm Springs NFH

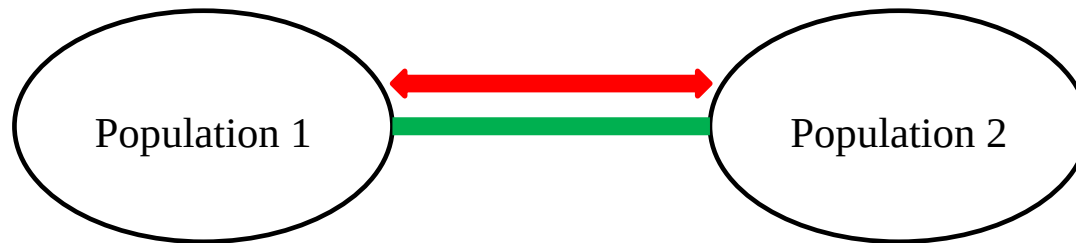


Jointly operated by USFWS and  
CTWSRO

# Integrated spring Chinook salmon program since 1978

Figure 15. Location of surface-water and water-quality stations in the Deschutes River Basin.

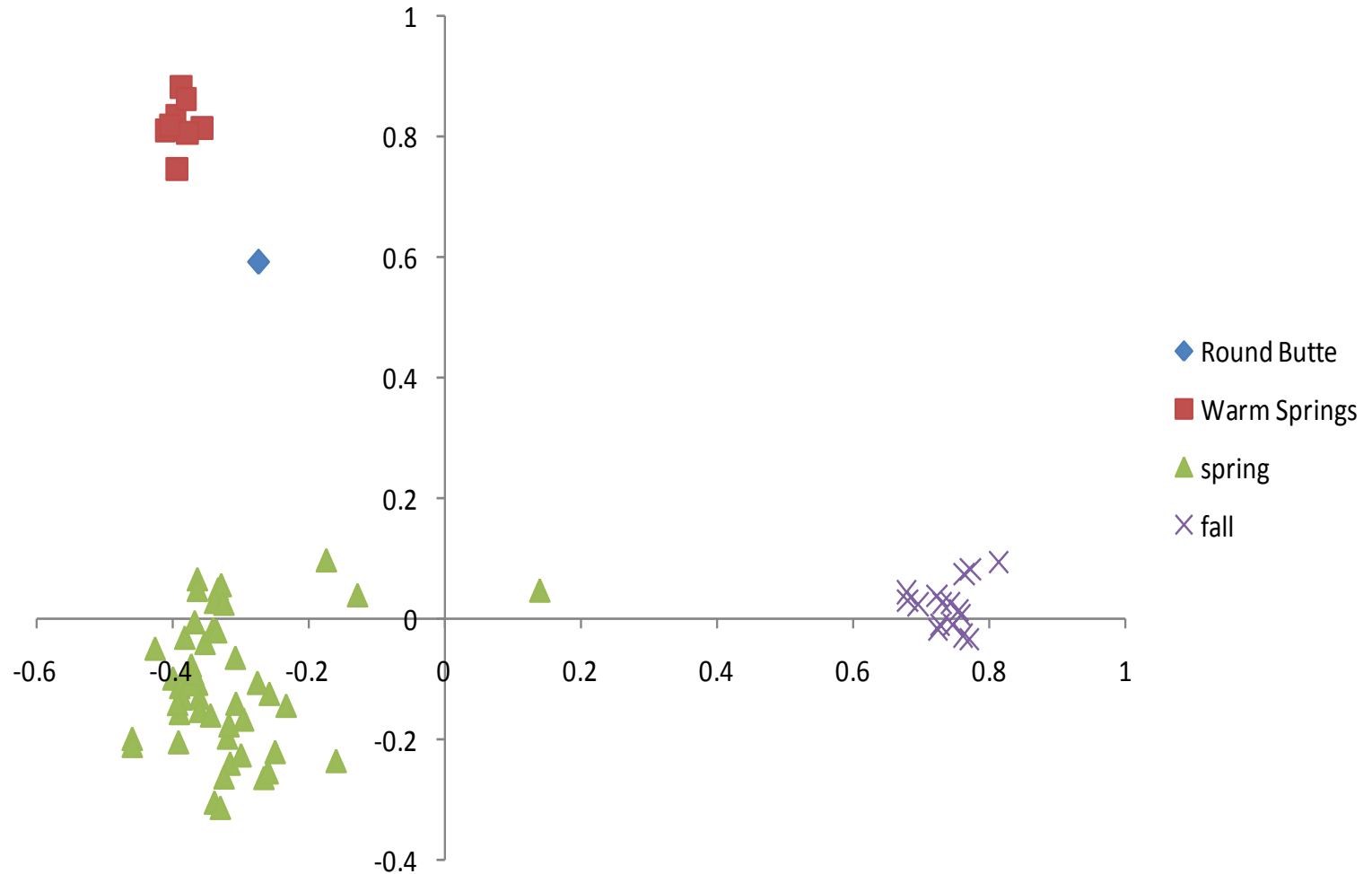
# Genetic divergence measured by neutral markers



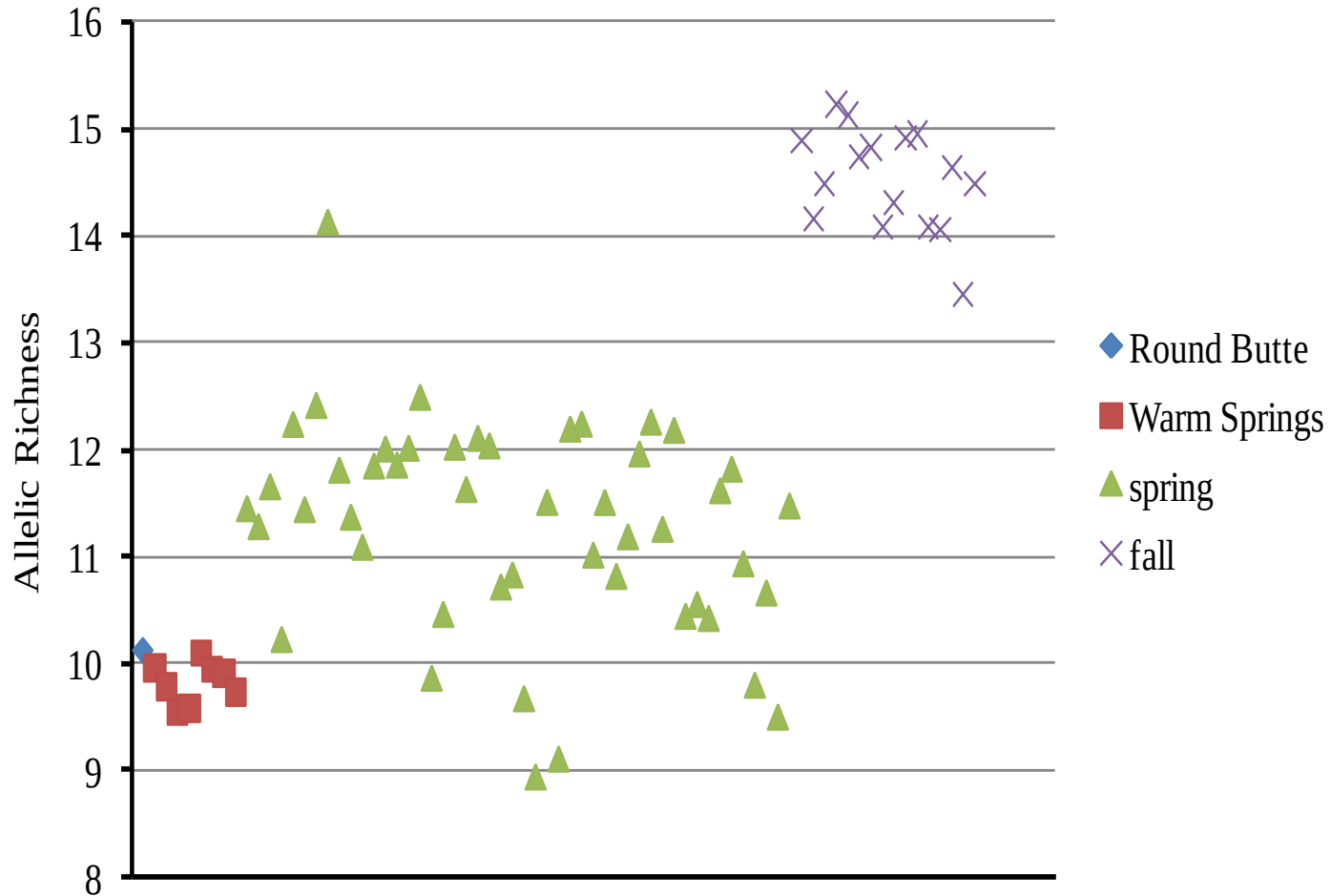
Has lack of NOB resulted in detectable divergence between hatchery and wild stocks?

How similar are Warm springs NFH and Round Butte H stocks to wild (unclipped) Deschutes R. Chinook salmon?

# Correspondence analysis of upper Columbia River Chinook salmon



# Genetic Diversity in Columbia River Chinook salmon populations





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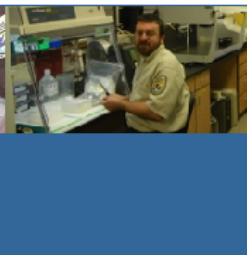
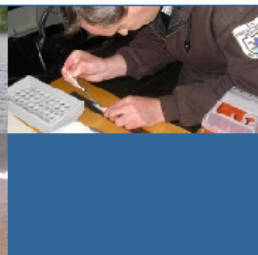
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## Genetic Profiles for Pacific Region and Pacific Southwest Region National Fish Hatchery Broodstocks

Stocks are listed by species, and Chinook salmon stocks are further divided among five recognized runs (spring, summer, fall, late-fall, and winter). Available reports are indicated by "pdf" which link to the actual report. Expected completion deadlines are given for stocks for which no reports are currently available. Reports will be updated periodically as additional data become available. A general description of methods used to generate reports is provided [here as a pdf file](#).

| Area                 | National Fish Hatchery | Chinook Salmon |        |      |           |        | Coho Salmon | Steelhead | Chum Salmon | Sockeye Salmon |
|----------------------|------------------------|----------------|--------|------|-----------|--------|-------------|-----------|-------------|----------------|
|                      |                        | Spring         | Summer | Fall | Late-Fall | Winter |             |           |             |                |
| Olympic Peninsula    |                        |                |        |      |           |        |             |           |             |                |
|                      | Quilcene               |                |        |      |           |        | pdf         |           |             |                |
|                      | Makah                  |                |        | pdf  |           |        | pdf         | 09/2012   |             |                |
|                      | Quinalt                |                |        | pdf  |           |        | pdf         | 09/2012   | 09/2012     |                |
| Columbia River Gorge |                        |                |        |      |           |        |             |           |             |                |
|                      | Spring Creek           |                |        | pdf  |           |        |             |           |             |                |
|                      | Little White           | 09/2012        |        | pdf  |           |        |             |           |             |                |
|                      | Carson                 | 09/2012        |        |      |           |        |             |           |             |                |
|                      | Eagle Creek            |                |        |      |           |        | 09/2012     |           |             |                |
| Middle Columbia      |                        |                |        |      |           |        |             |           |             |                |

# Acknowledgements

Samples and data were collected in cooperation with our partners and with the assistance of hatchery staff. Genotyping was conducted by the laboratory staff at AFTC



The findings and conclusions presented here are those of the author and do not necessarily represent the views of the U.S. Fish and Wildlife Service.